DOE/NV/25946--569

FIELD SURVEY

OF

CACTUS CRATER STORAGE FACILITY

(RUNIT DOME)

REPORT A08

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government or any agency thereof.

SCOPE

The US Department of Energy, Office of Health and Safety (DOE/HS-10), requested that National Security Technologies, LLC, Environmental Management directorate (NSTec/EM) perform a field survey of the Cactus Crater Storage Facility (Runit Dome), similar to past surveys conducted at their request. This field survey was conducted in conjunction with a Lawrence Livermore National Laboratory (LLNL) mission on Runit Island in the Enewetak Atoll in the Republic of the Marshall Islands (RMI). The survey was strictly a visual survey, backed up by digital photos and a written description of the current condition.

METHODOLOGY

The survey took place over the period of June 25 to 28, 2008. Team leader Doug Miller identified the potential concern to be recorded, described the potential concerns, and took digital photos of the potential concerns; Judy Honda assisted and captured all potential concerns on a written log; and anywhere from 3 to 6 Marshallese local hires assisted at any one time by clearing vegetation off the concrete dome so it could be seen visually. A sketch of the dome used in previous surveys, with numbering scheme for the panels, was utilized as a reference tool (Attachment 1). The written description of each potential concern was coded in a manner that allowed it to be matched up with the corresponding digital photo. The written log was later transcribed onto a typed listing and is attached to this report (Attachment 2); similarly, the digital photos were stored on a "thumb-drive" and are also attached to this report (Attachment 3). The survey started at the top of the dome and worked its way down row by row. Surface spalls smaller than 3" x 3" were not captured in this report. Some panels on the A-row did not have the vegetation and/or dirt sufficiently removed to observe the entire panel (bottom 2' to 5') as well.

VISUAL ASSESSMENT

A total of 357 concrete panels plus the center cap were inspected. No defects were noted on 138 of the panels. Of the remaining 219 panels, a total of 380 potential concerns were noted. Potential concern consisted of the following:

- Spalling
- Cracking
- Breaking/chipping
- Vegetation growing on the surface
- Vegetation taking root in joints
- Vegetation over-taking the panels
- Debris covering lowest 2' to 4' of some panels

Spalling was very prevalent across the entire dome. Although spalling was found more at the panel corners, there was significant spalling along the joint edges, and sometimes along cracks on the interior of the panel.

Spalling at panel corner

Spalling at panel edge.

Spalling along interior crack.

Cracking for the most part would be considered hairline, although some were approximately 1/64 to 1/16 of an inch wide. Cracks tended to run vertical versus horizontal, and most ran from panel edge to panel edge.

Vertical and horizontal cracks.

Breaking/chipping occurred in two locations at the panel corner and were about 6" deep.

6" deep broken corner #1.

6" deep broken corner #2.

Vegetation growing on the surface of the panels was prevalent in some areas and nonexistent is others.

Vines at higher elevations.

Brush at lower elevations.

Vegetation taking root in joints occurred in 4 to 5 locations, but did not appear to have penetrated the concrete panels.

Vine #1 rooted in joint.

Vine #2 rooted in joint.

Vegetation overtaking the panels occurred in a couple places, but did not penetrate the concrete panel.

Debris covered 2' to 4' of the bottom of numerous panels. Time did not allow all this debris to be cleared for an unobstructed view of the bottom panels.

TECHNICAL ASSESSMENT

A concrete subject matter expert (Terence C. Holland, D. Eng.) reviewed the visual assessment described above and noted the following:

- "In general, the photographs indicate that the concrete is in good condition and the dome was finished with a rough broom finish; most of the broom marks are visible."
- "There is no evidence in the photos that the concrete is showing any signs of disintegration, which is the loss of the ability of the paste to hold the concrete constituents together."
- "The damage that is seen falls into the general category of non-structural causes."

Additional conclusions in the area of "conditions of concrete," as well as "appropriate action for evaluation" and "possible repair strategies," can be found at Attachment 4.

SUMMARY

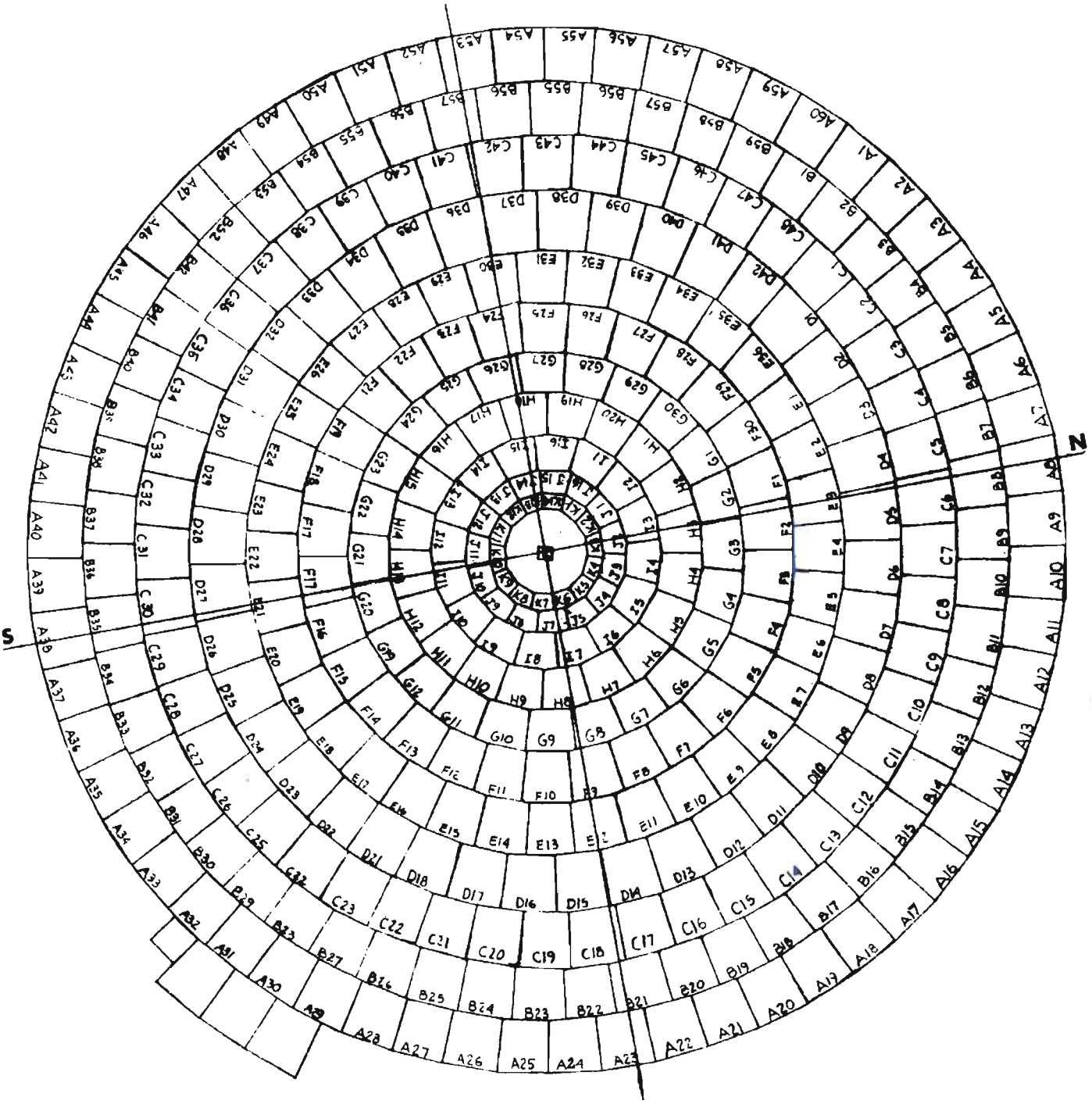
It is important to remember that this survey, like all previous surveys, is a visual surface survey and should in no way be construed as a structural survey. The results of this survey would be best used as documentation as to whether or not the defects are increasing in number and/or severity and for determining whether or not the dome will continue to function adequately as a containment structure. The dome continues to exhibit increased spalling and cracking, as noted in all previous surveys, although not at an alarming rate or severity. As noted in previous surveys as well, vegetation encroachment onto the panels is significant, although it does not appear to be causing a significant problem. The area of most concern is the two panel corners that have broken off and exposed the panels approximately 6" deep.

ATTACHMENTS

1. Sketch of Runit Dome panel layout.
2. Photo descriptions of Runit Dome field survey.
3. Digital photos from Runit Dome field survey.
4. Nevada Test Site General Report, Project No. 08109, Document No. 08109-RPT-0001. Runit Dome Concrete Dome Evaluation, Revision 0.

Attachment 1

Sketch of Runit Dome panel layout



SKETCH A82

Attachment 2

Photo descriptions of Runit Dome field survey

PHOTO DESCRIPTIONS
OF RUNIT DOME FIELD SURVEY

Line No.	PHOTO ID	PHOTO COMMENTS
1	A08-A1-1	Spall (4"x15") along bottom edge, approximately 4' from left corner.
2	A08-A2-1	Spall area (1'x8') along bottom edge, approximately in the center.
3	A08-A3-1	Spall (5"x8") at the top-left corner.
4	A08-A4-1	Spall area (6"x12") along bottom edge, approximately in the center.
5	A08-A5-1	Spall area (1'x5') at the top-left corner.
6	A08-A6-1	Spall (6"x24") along bottom edge, approximately 6' from the right corner.
7	A08-A7-1	Spall (2"x24") at the bottom-left corner.
8	A08-A7-2	Spall (4"x24") along the bottom edge, approximately in the center.
9	A08-A8-1	Spall (6"x 24") along the bottom edge, approximately 4' from the left corner.
10	A08-A8-2	Spall area (10"x48") along the bottom edge, approximately in the center.
11	A08-A9-1	Spall (3"x20") along the bottom edge, near the right corner.
12	A08-A9-2	Spall (4"x10") along the bottom edge, approximately in the center.
13	A08-A9-3	Spall (12"x24") along the bottom edge, to the left of center.
14	A08-A9-4	Hairline crack in the center runnning horizontal for approximately 4' (crack follows dark grey wet area).
15	A08-A10-1	Spall (5"x10") along the bottom edge, to the left of center.
16	A08-A10-2	Spall (2"x12") along the bottom edge, near the left corner.
17	A08-A11-1	Tree grown over the bottom edge of the panel, but had not penetrated the concrete panel. Time required to remove the tree prevented us from viewing approximately the bottom 4' of the panel.
18	A08-A11-2	Spall (3"x4") at the top-right corner.
19	A08-A12-1	Spall (3"x5") along the right edge, approximately in the center.
20	A08-A13-1	Spall (3"x5") at the top-left corner.
21	A08-A13-2	Spall (3""x10") at the bottom-left corner running vertical. Spall (3"X10") at the bottom-left corner running horizontal.
22	A08-A14-1	Spall (4"x5") at the top-right corner.
23	A08-A14-2	Spall (4"x6") at the top-left corner.
24	A08-A15-1	Spall (6"x6") along the left edge, approximately in the center.
25	A08-A15-2	Spall (4"x4") along the right edge, approximately in the center.
26	A08-A16-1	Spall (4"x6") at the bottom-left corner.
27	A08-A16-2	Spall (4"x8") along the bottom edge, right of center.
28	A08-A16-3	Hairline crack running from the right edge (center) to the left edge (center) (crack follows dark grey wet area).
29	A08-A17-1	Spall (4"x8") along the bottom edge, right of center.
30	A08-A17-2	Spall (3"x6") along the bottom edge, near center.
31	A08-A17-3	Spall (6"x12") along the bottom edge, left of center.
32	A08-A17-4	Spall (4"x3") along the left edge, near center.
33	A08-A18	No discrepancies and no photo.
34	A08-A19-1	Hairline crack running from the center of the bottom edge to the center of the top edge.
35	A08-A19-2	Spall area (1'x3') along the bottom edge, near center.
36	A08-A20-1	Spall (8"x20") at the bottom-left corner.
37	A08-A20-2	Spall (3"x3") along the bottom edge, near center.

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OF RUNIT DOME FIELD SURVEY

38	A08-A20-3	Spall (3"x8") along the bottom edge, 4' from left corner.
39	A08-A20-4	Spall (6"x8") at the bottom-right corner.
40	A08-A21-1	Tree grown over the bottom edge of the panel, but had not penetrated the concrete panel. Time required to remove the tree prevented us from viewing the bottom edge of the panel. No other discrepancies noted.
41	A08-A22-1	Hairline crack from center of left edge to center of the right edge.
42	A08-A22-2	Spall (6"x3') at bottom-left corner.
43	A08-A22-3	Spall area (5"x4') at bottom-right corner.
44	A08-A23-1	Hairline crack from center of left edge to center of the right edge.
45	A08-A23-2	Spalls along the bottom edge (photo gives an example).
46	A08-A24-1	Hairline crack from center of left edge to center of the right edge.
47	A08-A24-2	Hairline crack from center of top edge to horizontal crack in the center of panel.
48	A08-A24-3	Spall area (12"x36") along bottom edge.
49	A08-A25	No discrepancies and no photo.
50	A08-A26-1	Hairline crack from left edge, about 8' from the bottom, to the right edge.
51	A08-A26-2	Vegatation and dirt covered the bottom 3' of the panel.
52	A08-A27-1	Spall (3"x6") at top-left corner.
53	A08-A27-2	Hairline crack from center of the bottom edge and running vertical to the center of the panel.
54	A08-A27-3	Vegatation and dirt covered the bottom 3' of the panel and was not observed.
55	A08-A28-1	Vegatation and dirt covered the bottom 3' of the panel and was not observed.
56	A08-A29-1	Vegatation and dirt covered the bottom 2' of the panel and was not observed.
57	A08-A30-1	Spall (3"x8") along the bottom edge, near center.
58	A08-A31-1	Spall area all along the bottom edge; photo provides an example.
59	A08-A31-2	Hairline crack from the middle of the top edge running vertically down about 5'.
60	A08-A32-1	Spall (3"x12") at top-right corner.
61	A08-A32-2	Spall (4"x4") at bottom-left corner.
62	A08-A32-3	Crack (1/36") from bottom edge, right center.
63	A08-A33	No discrepancies and no photo.
64	A08-A34-1	Crack (1/16") starting 8" off the left edge center and running vertical to the top edge, with spalling.
65	A08-A34-2	Vegatation and dirt covered the bottom 5' of the panel and was not observed.
66	A08-A35-1	Vegatation and dirt covered the bottom 5' of the panel and was not observed.
67	A08-A36-1	Spall (3"x9") at top-left corner.
68	A08-A36-2	Spall (2"x10") along top edge approximately 4' from left corner.
69	A08-A36-3	Vegatation and dirt covered the bottom 4' of the panel and was not observed.
70	A08-A37-1	Spall (2"x6") along top edge approximately 4' from roght corner.
71	A08-A37-2	Vegatation and dirt covered the bottom 4' of the panel and was not observed.

PHOTO DESCRIPTIONS
OF RUNIT DOME FIELD SURVEY

72	A08-A38-1	Spall (4"x4") at top-left corner
73	A08-A38-2	Vegatation and dirt covered the bottom 3' of the panel and was not observed.
74	A08-A39-1	Vegatation and dirt covered the bottom 3' of the panel and was not observed.
75	A08-A40-1	Vegatation and dirt covered the bottom 2' of the panel and was not observed.
76	A08-A41	No discrepancies and no photo.
77	A08-A42	No discrepancies and no photo.
78	A08-A43-1	Spall (3"x8") at top-right corner.
79	A08-A43-2	Spall area (2"x4') along bottom edsge approximately 2' from corner.
80	A08-A44-1	Cracked (8"x12") to-right corner.
81	A08-A44-2	Hairline crack from right side center to left side center.
82	A08-A44-3	Vegatation and dirt covered the bottom 2' of the panel and was not observed.
83	A08-A45-1	Spall (6"x5") at top-right corner.
84	A08-A45-2	Vegatation and dirt covered the bottom 3' of the panel and was not observed.
85	A08-A46	No discrepancies and no photo.
86	A08-A47-1	Spalls along the entire bottom edge (photo gives an example by the bottom left corner).
87	A08-A48-1	Spalling along the bottom edge of entire panel; as an example, see cracking and spalling (12"x24") at bottom-left corner.
88	A08-A49-1	Cracking and spalling along bottom edge.
89	A08-A50-1	Spall (5"x6") at top-left corner.
90	A08-A51-1	Hairline crack from left edge center to center of panel.
91	A08-A51-2	Spall (5"x6") at top-right corner.
92	A08-A51-3	Spall (5"x8") along bottom edge, center-left.
93	A08-A52-1	Spalling (5"x4') along the bottom edge near center of panel.
94	A08-A53-1	Spall (5"x9") along bottom edge, center-left.
95	A08-A53-2	Spall (8"x10") along bottom edge, 2' from bottom-right corner.
96	A08-A54-1	Spall (3"x6") at bottom-left corner.
97	A08-A54-2	Spall (6"x8") at top-left corner.
98	A08-A55-1	Spall (10"x3") at bottom-right corner.
99	A08-A55-2	Spall area (4"x4') along bottom edge, center-left.
100	A08-A56-1	Spall (6"x12") along top edge, near center.
101	A08-A56-2	Spall (8"x20") along bottom edge, center-left.
102	A08-A57-1	Spall (5"x10") along the bottom edge, to the left of center.
103	A08-A57-2	Spall (6"x12") along the bottom edge, near center.
104	A08-A58-1	Spall area (4"x3') along left edge, about 3' from the top-left corner.
105	A08-A58-2	Spall (5"x7") at top-right corner.
106	A08-A58-3	Spall (8"x10") along bottom edge, near center.
107	A08-A58-4	Spall (5"x10") along bottom edge, about 3' from bottom-right corner.
108	A08-A59-1	Spall area (3"x10') along bottom edge, near center.
109	A08-A60-1	Spall (4"x5") at top-left corner.
110	A08-A60-2	Spall (3"x9") along bottom edge, center-right.
111	A08-B1-1	Top-left corner broken (18"x18"), about 6" deep.
112	A08-B1-2	Hairline crack from left edge, between center and top, to right edge.

PHOTO DESCRIPTIONS
OF RUNIT DOME FIELD SURVEY

113	A08-B1-3	Spall (3"x24") at bottom-right corner.
114	A08-B2-1	Crack (1/32") w/spalling from center of left edge to center of right edge.
115	A08-B3-1	Spall (3"x3") at bottom-right corner.
116	A08-B3-2	Spall (4"x12") at bottom-left corner.
117	A08-B3-3	Spall (4"x18") along bottom edge, 5' from left corner.
118	A08-B3-4	Hairline crack from middle of left edge to middle of right edge.
119	A08-B4	No discrepancies and no photo.
120	A08-B5	No discrepancies and no photo.
121	A08-B6-1	Crack (1/16") from center of bottom edge towards top edge for 5', then splitting in 2 directions.
122	A08-B7	No discrepancies and no photo.
123	A08-B8-1	Hairline crack from left edge, about 4' from bottom, 10' long.
124	A08-B9	No discrepancies and no photo.
125	A08-B10-1	Hairline crack from right edge, about 8' from bottom, to center of panel.
126	A08-B11	No discrepancies and no photo.
127	A08-B12-1	Hairline crack from center-left of bottom edge, running vertically towards top edge.
128	A08-B13	No discrepancies and no photo.
129	A08-B14-1	Spall (3"x8") at top-right corner.
130	A08-B14-2	Multiple hairline cracks.
131	A08-B14-3	Spall (1"x 12") at bottom-left corner and 3" deep.
132	A08-B15	No discrepancies and no photo.
133	A08-B16-1	Spall (3"x8") at top-right corner.
134	A08-B17-1	Spall (3"x9") at bottom-right corner.
135	A08-B18	No discrepancies and no photo.
136	A08-B19	No discrepancies and no photo.
137	A08-B20	No discrepancies and no photo.
138	A08-B21	No discrepancies and no photo.
139	A08-B22	No discrepancies and no photo.
140	A08-B23-1	Crack (1/32") from bottom edger, 5' from left corner, angling to the right rdge.
141	A08-B24	No discrepancies and no photo.
142	A08-B25-1	Spall (5"x5") from center of left edge, 7' from the top.
143	A08-B25-2	Hairline crack from left edge to center of panel.
144	A08-B26	No discrepancies and no photo.
145	A08-B27-1	Spall (4"x6") at top-left corner.
146	A08-B28-1	Multiple hairline cracks (example).
147	A08-B29-1	Spall (3"x18") along the bottom edge, 6' from right corner.
148	A08-B29-2	Hairline crack in center of panel, approximately 4' long.
149	A08-B30-1	Multiple hairline cracks (example).
150	A08-B31-1	Spall (7"x10") at tp-right corner.
151	A08-B31-2	Hairline crack from middle of bottom edge going vertical 5'.
152	A08-B32	No discrepancies and no photo.
153	A08-B33	No discrepancies and no photo.
154	A08-B34	No discrepancies and no photo.
155	A08-B35-1	Spall (2"x30") along bottom edge, near center.
156	A08-B36	No discrepancies and no photo.
157	A08-B37	No discrepancies and no photo.
158	A08-B38	No discrepancies and no photo.
159	A08-B39-1	Spal (6"x6") along top edge, 2' from corner.

PHOTO DESCRIPTIONS
OF RUNIT DOME FIELD SURVEY

160	A08-B40	No discrepancies and no photo.
161	A08-B41-1	Spall (3"x24") near bottom-right corner.
162	A08-B41-2	Spall (4"x6") at bottom-left corner.
163	A08-B42-1	Spall (15"x24") at bottom-left corner.
164	A08-B43	Doesn't exist.
165	A08-B44	Doesn't exist.
166	A08-B45	Doesn't exist.
167	A08-B46	Doesn't exist.
168	A08-B47	Doesn't exist.
169	A08-B48	Doesn't exist.
170	A08-B49	Doesn't exist.
171	A08-B50	Doesn't exist.
172	A08-B51	Doesn't exist.
173	A08-B52-1	Spall (3"x6') along bottom edge, near center.
174	A08-B52-2	Hairline crack from bottom edge, 7' from right corner, going vertical
175	A08-B53-1	Spall (15"x30") at bottom-right corner.
176	A08-B54-1	Spall (3"x36") at bottom-left corner.
177	A08-B55-1	Spall (2"x24") along bottom edge, near middle.
178	A08-B55-2	Spall (3"x4") at bottom-left corner.
179	A08-B56-1	Spall (3"x4") at bottom-right corner.
180	A08-B57	No discrepancies and no photo.
181	A08-B56(2)-1	No discrepancies and no photo.
182	A08-B55(2)	No discrepancies and no photo.
183	A08-B56(3)-1	Hairline crack along the left side center to the right edge center.
184	A08-B56(3)-2	Hairline crack from bottom edge center, running vertical to the panel center.
185	A08-B57(2)-1	Hairline crack along the left side center to right side center.
186	A08-B58-1	Crack (1/32") w/spalling from left side center to right side center.
187	A08-B58-2	Spall (5"x24") at right-side corner.
188	A08-B58-3	Spall (5"x8")along bottom edge, 4' from right corner.
189	A08-B59-1	Spall (2"x84") along left edge near bottom corner.
190	A08-C1-1	Spall (12"x24") at bottom-right corner.
191	A08-C2-1	Hairline crack from center of left edge towards the panel center.
192	A08-C3	No discrepancies and no photo.
193	A08-C4	No discrepancies and no photo.
194	A08-C5-1	Spall (3"x6") at toop-left corner.
195	A08-C6	No discrepancies and no photo.
196	A08-C7-1	Multiple hairline cracks 1-2' long.
197	A08-C8-1	Spall (3"x9") along bottom edge, 5' from right corner.
198	A08-C9	No discrepancies and no photo.
199	A08-C10	No discrepancies and no photo.
200	A08-C11	No discrepancies and no photo.
201	A08-C12	No discrepancies and no photo.
202	A08-C13	No discrepancies and no photo.
203	A08-C14-1	Hairline crack about 8' long vertically in the panel center.
204	A08-C15-1	Hairline crack w/spalling across the bottom-left corner.
205	A08-C16-1	Spall (8"x18") at bottom-right corner.
206	A08-C16-2	Spall (3"x4") along the bottom edge, 5' from the right corner.
207	A08-C16-3	Spall (4"x3") at bottom-left corner.
208	A08-C16-4	Spall (3"x6") along the top edge, near center.
209	A08-C16-5	Hairline crack from center right edge to center of left edge.

PHOTO DESCRIPTIONS
OF RUNIT DOME FIELD SURVEY

210	A08-C17	No discrepancies and no photo.
211	A08-C18	No discrepancies and no photo.
212	A08-C19-1	Spall (5"x10") at bottom-right corner.
213	A08-C20-1	Spall (12"x36") at top-right corner.
214	A08-C20-2	Spall (5"x8') at bottom-left corner.
215	A08-C20-3	Hairline crack from bottom edge to top edge.
216	A08-C21-1	Spall (3"x3') at bottom-right corner.
217	A08-C22-1	Several hairline cracks.
218	A08-C23-1	Spall (3"x6") along the bottom edge, near center.
219	A08-C24-1	Hairline crack across the botton-right corner.
220	A08-C25-1	Spall (6"x12") at the bottom-right corner.
221	A08-C26-1	Spall (8"x12") at bottom-right corner.
222	A08-C26-2	Spall (2"x14") along bottom edge, near center.
223	A08-C26-3	Spall (12"x48") at bottom-left corner.
224	A08-C27-1	Spall (2"x24") along the left edge, 7' from the top.
225	A08-C28-1	Spall (3"x18") along the bottom edge, 5' from left corner.
226	A08-C29-1	Spall (4"x8") along the top edge, 3' from right corner.
227	A08-C29-2	Spall (2"x24") at bottom-left corner.
228	A08-C29-3	Spall (3"x10") along left edge, 6' from bottom.
229	A08-C30	No discrepancies and no photo.
230	A08-C31-1	Hairline crack from left edge center to right edge center.
231	A08-C31-2	Hairline crack w/spalling from bottom edge center to center of panel.
232	A08-C32-1	Spall (4"x36") at bottom-left corner.
233	A08-C33-1	Spall (4"x6") at bottom-right corner.
234	A08-C34-1	Spall (3"x6") at bottom-right corner.
235	A08-C35-1	Spall (6"x8") at top-left corner.
236	A08-C36-1	Spall (3"x12") at bottom-right corner.
237	A08-C36-2	Hairline crack along right edge, 7' from bottom, and 5' long.
238	A08-C36-3	Hairline crack along left edge, 4' from top, and 4' long.
239	A08-C36-4	Plugged borehole from previous survey.
240	A08-C36-5	Hairline crack along left edge, 6' from bottom, 7' long.
241	A08-C37-1	Spall (5"x18") at bottom-left corner.
242	A08-C38-1	Hairline crack along right edge, near center, 6' long.
243	A08-C38-2	Hairline crack along right edge, 6' from top, 4' long.
244	A08-C38-3	Hairline crack along left edge, near center, 6' long.
245	A08-C39-1	Spall (4"x24") at bottom-left corner.
246	A08-C40-1	Spall (3"x6") at bottom-right corner.
247	A08-C40-2	Hairline crack from center of left edge to center of panel.
248	A08-C40-3	Hairline crack from center of right edge to center of panel.
249	A08-C40-4	Hairline crack from bottom edge, left center, 4' long.
250	A08-C41-1	Spall (5"x36") at top left corner.
251	A08-C41-2	Hairline crack from bottom edge, near center, to center of panel.
252	A08-C42	No discrepancies and no photo.
253	A08-C43-1	Top-left corner broken (10"x30"), about 6" deep.
254	A08-C43-2	Top-left corner broken (10"x30"), about 6" deep (side view).
255	A08-C44-1	Hairline crack from left edge to right edge.
256	A08-C44-2	Hairline crack from bottom edge, near center, to center of panel.
257	A08-C44-3	Spall (4"x12") at bottom-left corner.
258	A08-C44-4	Spall (5"x8") from bottom edge, 6' from left corner.
259	A08-C45	No discrepancies and no photo.
260	A08-C46	No discrepancies and no photo.

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261	A08-C47	No discrepancies and no photo.
262	A08-C48-1	Spall (4"x24") at bottom-right corner.
263	A08-D1-1	Crack (1/32" to hairline) from the middle of the left edge to the middle of the right edge.
264	A08-D1-2	Hairline crack from middle of bottom edge to middle of panel
265	A08-D1-3	Hairline crack from middle-right of bottom edge to middle of panel
266	A08-D2-1	Crack (1/16") running from the middle of the bottom-edge to the middle-right of the top edge.
267	A08-D2-2	Crack (1/32") running from right side edge to verticle crack.
268	A08-D2-3	Hairline crack from middle of bottom edge and running 9' vertical.
269	A08-D3	No discrepancies and no photo.
270	A08-D4	No discrepancies and no photo.
271	A08-D5-1	Hairline cracks (3 ea) radiating from plugged borhole.
272	A08-D6-1	Crack (1/32") with spalling running from left middle edge to right edge.
273	A08-D7	No discrepancies and no photo.
274	A08-D8-1	Spall (4"x5") at bottom-left corner.
275	A08-D9-1	Crack (1/16") running from middle of left edge to the right edge.
276	A08-D9-2	Crack (1/32") running from bottom edge to center of panel.
277	A08-D10	No discrepancies and no photo.
278	A08-D11	No discrepancies and no photo.
279	A08-D12-1	Broken (4"x5") top-right corner...
280	A08-D13-1	Hairline crack from middle of bottom edge to top edge.
281	A08-D14-1	Hairline crack from middle of bottom edge to top edge.
282	A08-D15-1	Crack (1/16") running from middle of left edge to the right edge.
283	A08-D15-2	Crack (1/16") running from bottom edge to top edge with spalling.
284	A08-D15-3	Cracks (2 previous) intersect at center of panel.
285	A08-D16-1	Spall (3"x12") at bottom-right corner.
286	A08-D16-2	Spall (6"x8") at bottom left corner.
287	A08-D17-1	Spall (4"x12") at bottom-left corner.
288	A08-D17-2	Multiple hairline cracks.
289	A08-D18-1	Spall (3"x6") at top-right corner.
290	A08-D18-2	Spall (3"x6") at bottom-right corner.
291	A08-D18-3	Spall (3"x5") along bottom edge, 5' from left corner.
292	A08-D19	Panel does not exist on 1982 sketch or physically.
293	A08-D20	Panel does not exist on 1982 sketch or physically.
294	A08-D21-1	Spall (3"x8") along bottom edge, approximately 6' from right corner.
295	A08-D21-2	Spall (2"x9") along bottom edge, near center.
296	A08-D21-3	Crack (1/32") from center of bottom edge to top edge w/spalling.
297	A08-D21-4	Hairline crack along left edge, near center, to vertical crack.
298	A08-D22-1	Spall (15"x12") at bottom-left corner.
299	A08-D22-2	Hairline crack with spalling that cuts across the bottom-right corner.
300	A08-D23-1	Crack (1/32") running from bottom edge near right corner vertical, then splitts into 3 cracks.
301	A08-D23-2	Hairline crack starts along the left edge, near the bottom-left corner and angles towards the top-right corner on the right edge.
302	A08-D24-1	Hairline crack from center of left edge, 6' towards the center of the panel.

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303	A08-D25-1	Spall (4"x10") near bottom-right corner.
304	A08-D26-1	Hairline crack from center bottom edge vertical for about 5'.
305	A08-D27-1	Spall (4" x10") at bottom right corner.
306	A08-D27-2	Hairline crack from center bottom edge.
307	A08-D28	No discrepancies and no photo.
308	A08-D29-1	Hairline crack from center of left edge towards the panel center.
309	A08-D30-1	Spall (6"x6") at top-left corner.
310	A08-D31-1	Crack (1/32") w/spalling cutting across the bottom left corner.
311	A08-D32	No discrepancies and no photo.
312	A08-D33-1	Spall (5"x5") at top-right corner.
313	A08-D34-1	Spall (3"x8") at bottom-left corner.
314	A08-D35-1	Spall (5"x7") at top-right corner.
315	A08-D35-2	Spall (4"x6") at bottom-left corner.
316	A08-D35-3	Crack (1/32") running vertically from the center of the bottom edge to the top edge.
317	A08-D35-4	Hairline crack from the middle of the left edge to the center of the panel.
318	A08-D36-1	Crack (1/32") from center of the bottom edge to the top edge.
319	A08-D37-1	Spall area (3"x3.5') at bottom-right corner.
320	A08-D38-1	Broken (5"x10") to-left corner.
321	A08-D39-1	Spall (2"x14") along bottom edge, 4' from right corner.
322	A08-D39-2	Spall (3"x18") at the center of the bottom edge.
323	A08-D39-3	Spall (3"x9") at bottom-left corner.
324	A08-D39-4	Hairline crack along right edge, near center.
325	A08-D40-1	Spall (4"x18") at bottom-right corner.
326	A08-D41-1	Crack (1/16") w/spallingfrom bottom-to-top-illegle.
327	A08-D41-2	Hairline crack across bottom-left corner.
328	A08-D42-1	Spall area (2"x5') along bottom-left corner.
329	A08-D42-2	Hairline crack from center of left edge going about 5' towards the panel center.
330	A08-E1	No discrepancies and no photo.
331	A08-E2-1	Spalls (3 each) near bottom-right corner: 4"x2" at corner;1"x9" left of corner along bottom edge; and 2"x6" up from corner along right edge.
332	A08-E2-2	Multiple hairline cracks (cracks follow dark grey wet areas).
333	A08-E3-1	Spall (4"x5") along top edge, approximately 4' from top-right corner.
334	A08-E4-1	Spall (6"x8") at top-right corner.
335	A08-E4-2	Hairline crack starting at the center of the bottom edge and angling up towards the top-right corner for approximately 13' (crack follows dark grey wet area).
336	A08-E5-1	Bottom-right corner cracked (4"x5").
337	A08-E6	No discrepancies and no photo.
338	A08-E7	No discrepancies and no photo.
339	A08-E8-1	Hairline crack starting at the center of the bottom edge and going up for approximately 5' (crack follows dark grey wet area).
340	A08-E9-1	Crack (1/32") with spalling starting at the center of the bottom edge and going all the way up to the top edge (crack follows dark grey wet area).

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341	A08-E9-2	Hairline crack starting at the center of the bottom edge (left side of photo), just to the left of the crack mentioned in A08-E-1 (right side of photo), and going up for approximately 7' (crack follows dark grey wet area).
342	A08-E10-1	Top-right corner cracked (4"x4").
343	A08-E11-1	Top-left corner cracked (3"x4").
344	A08-E11-2	Hairline crack starting at the center of the bottom edge and going up to the center of panel and splitting in two, one split going to the left edge and the other split going to the top edge (crack follows dark grey wet area).
345	A08-E12-1	Spall (11"x11") at top-left corner.
346	A08-E12-2	Crack (1/32" to hairline) with spalling from middle of top edge to bottom left corner.
347	A08-E13	No discrepancies and no photo.
348	A08-E14-1	Multiple hairline cracks on left side of panel (cracks follow dark grey wet areas).
349	A08-E14-2	Multiple hairline cracks on right side of panel (cracks follow dark grey wet areas).
350	A08-E15-1	Spall (2"x30") along bottom edge on right side.
351	A08-E15-2	Spall (4"x5") at bottom-left corner.
352	A08-E15-3	Spall (5"x7") along bottom edge on left side.
353	A08-E15-4	Spall along left edge, lower-middle.
354	A08-E15-5	Multiple cracks radiating from bottom edge to 3 different ares of panel.
355	A08-E15-6	Hairline crack cuts across bottom-right corner.
356	A08-E16-1	Spall (5"x5") at top-right corner.
357	A08-E17-1	Multiple hairline cracks radiating from center of panel.
358	A08-E17-2	Spall area (4' long) along bottom edge, near middle.
359	A08-E17-3	Spall (2"x12") along bottom left edge.
360	A08-E18-1	Hairline cracks (3 ea) radiating from center of panel.
361	A08-E18-2	Hairline crack across top-right corner.
362	A08-E19-1	Spall (6"x6") at bottom-right corner.
363	A08-E19-2	Spall (3"x10") at bottom-left corner.
364	A08-E19-3	Spall (6"x12") at top-left corner.
365	A08-E19-4	Multiple hairline cracks on left side of panel (cracks follow dark grey wet areas).
366	A08-E19-5	Multiple hairline cracks on right side of panel (cracks follow dark grey wet areas).
367	A08-E20-1	Hairline crack from center of left edge to center of right edge.
368	A08-E21	No discrepancies and no photo.
369	A08-E22-1	Multiple cracks (hairline to 1/32") on left side of panel.
370	A08-E22-2	Multiple cracks (hairline to 1/32") on right side of panel.
371	A08-E23-1	Spall (4"x5") at bottom-left corner.
372	A08-E24-1	Spalls (3"x14" and 3"x10") at bottom-right corner.
373	A08-E24-2	Spall (2"x10") along bottom edge, near center.
374	A08-E24-3	Spall (3"x9") along bottom edge, near left corner.
375	A08-E24-4	Spall (3"x9") at bottom-left corner.
376	A08-E24-5	Crack from bottom edge to top edge with multiple cracks radiating out to side edges.
377	A08-E25	No discrepancies and no photo.
378	A08-E26-1	Hairline crack from bottom-right corner to top-left corner.
379	A08-E26-2	Crack (1/32") across bottom-left corner.

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380	A08-E27-1	Crack (1/32") from right edge center to left edge center with spalling.
381	A08-E27-2	Hairline cracks (2 ea) crossing each other in middle of panel.
382	A08-E27-3	Hairline crack from bottom-right edge going up toward the center of the panel.
383	A08-E28	No discrepancies and no photo.
384	A08-E29-1	Spall (3"x9") along bottom edge near right corner.
385	A08-E29-2	Spall (2"x4") along bottom edge, near center.
386	A08-E29-3	Spall (4"x4") at top-right corner.
387	A08-E29-4	Crack (1/16") from the center of the top edge to the middle of the panel, then it splits towards the right and left bottom corners with spalling (this photo shows the top part of crack).
388	A08-E29-5	Crack (1/16") from the center of the top edge to the middle of the panel, then it splits towards the right and left bottom corners with spalling (this photo shows the bottom part of crack).
389	A08-E30-1	Hairline crack starting on right edge, approximately 5' from top of panel, and heading toward the middle of the panel.
390	A08-E31-1	Hairline crack from bottom edge near middle radiating about 5' towards center of panel.
391	A08-E31-2	Hairline crack from bottom edge towards right side and reaching the top edge.
392	A08-E32	No discrepancies and no photo.
393	A08-E33-1	Multiple hairline cracks running vertical.
394	A08-E34	No discrepancies and no photo.
395	A08-E35-1	Crack across the top-right corner.
396	A08-E36-1	Spall (9"x9") at top-right corner.
397	A08-E36-2	Spall (4"x20") along top edge, 5' from right corner.
398	A08-E36-3	Spall (4"x15") along bottom edge, approximately 2' from right corner.
399	A08-F1-1	Hairline cracks (5 each) starting at the center of the panel and radiating outward (cracks follows dark grey wet area).
400	A08-F2-1	Spall (3"x3") at bottom-left corner.
401	A08-F3-1	Hairline cracks (multiple) with spalling (cracks follow dark grey wet areas).
402	A08-F3-2	Hairline cracks (multiple) with spalling (cracks follow dark grey wet areas).
403	A08-F3-3	Spall (3"x4") along left edge approximately 5' from bottom-left corner.
404	A08-F4-1	Spall (4"x4") at top-left corner.
405	A08-F5	No discrepancies and no photo.
406	A08-F6-1	Spall (4"x30") along bottom edge.
407	A08-F7-1	Spall (3"x7") at bottom-right corner.
408	A08-F8	No discrepancies and no photo.
409	A08-F9-1	Hairline crack with spalling from middle of bottom edge going vertical and then splitting (cracks follow dark grey wet areas).
410	A08-F10-1	Spall (4"x8") near middle of bottom edge.
411	A08-F11	No discrepancies and no photo.
412	A08-F12	No discrepancies and no photo. Panel has a capped bore-hole.
413	A08-F13	No discrepancies and no photo.
414	A08-F14-1	Spall (1"x10") at bottom-left corner.
415	A08-F15	No discrepancies and no photo.

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416	A08-F16-1	Hairline cracks (2 each) starting at the bottom edge and running vertical (cracks follows dark grey wet area).
417	A08-F17-1	Hairline crack going from the middle of the right edge to the middle of the left edge (crack follows dark grey wet area).
418	A08-F17-2	Spall (4"x7") at bottom-right corner.
419	A08-F18-1	This is the second F17 panel on the 1982 sketch. Spall (4"x4") at top-right corner.
420	A08-F18-2	This is the second F17 panel on the 1982 sketch. Hairline crack going from the middle of the bottom edge to the middle of the panel (crack follows dark grey wet area).
421	A08-F19	This is panel F18 on the 1982 sketch. No discrepancies and no photo.
422	A08-F20-1	This is panel F19 on the sketch, as panel F20 is missing from the 1982 sketch. Hairline crack going from the middle of the bottom edge to the middle of the panel, approximately 8' (crack follows dark grey wet area).
423	A08-F21	No discrepancies and no photo.
424	A08-F22	No discrepancies and no photo.
425	A08-F23-1	Hairline crack starting at the left edge about in the middle and running horizontal approximately 7' and then splits (crack follows dark grey wet area).
426	A08-F24-1	Spall (4"x10") at bottom-left corner.
427	A08-F25-1	Spall (3"x5") at bottom-right corner.
428	A08-F26	No discrepancies and no photo.
429	A08-F27-1	Spall (3"x10") at bottom-right corner.
430	A08-F27-2	Multiple hairline cracks on left side of panel (cracks follow dark grey wet areas).
431	A08-F27-3	Multiple hairline cracks on right side of panel (cracks follow dark grey wet areas).
432	A08-F28	No discrepancies and no photo.
433	A08-F29-1	Spall (2"x7") at top-left corner.
434	A08-F29-2	Hairline cracks (2 ea) from the bottom-center up for about 5'.
435	A08-F30-1	Hairline crack from bottom edge near middle up to the center of the panel.
436	A08-G1-1	Spall (3"x5") at top-left corner.
437	A08-G2	No discrepancies and no photo.
438	A08-G3	No discrepancies and no photo.
439	A08-G4-1	Spall (3"x4") at top-left corner.
440	A08-G4-2	Hairline crack starting at the left edge about 3' above bottom-corner and running horizontal approximately 6' and then splitting into 2 cracks (cracks follows dark grey wet area).
441	A08-G5	No discrepancies and no photo.
442	A08-G6	No discrepancies and no photo.
443	A08-G7-1	Hairline crack starting at the bottom edge about 5' from the bottom-corner and running vertical approximately 10' (crack follows dark grey wet area).
444	A08-G8	No discrepancies and no photo.
445	A08-G9-1	Hairline crack starting at the bottom edge about in the middle and running vertical approximately 15' (crack follows dark grey wet area).
446	A08-G9-2	Spall (3"x12") at bottom-left corner.
447	A08-G10	No discrepancies and no photo.

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448	A08-G11	No discrepancies and no photo.
449	A08-G12	No discrepancies and no photo.
450	A08-G13	Panel does not exist.
451	A08-G14	Panel does not exist.
452	A08-G15	Panel does not exist.
453	A08-G16	Panel does not exist.
454	A08-G17	Panel does not exist.
455	A08-G18	Panel does not exist.
456	A08-G19-1	Crack (1/16") with spalling starting at the center of the bottom edge and going all the way up to the top edge (crack follows dark grey wet area). Panel has a capped bore-hole.
457	A08-G20	No discrepancies and no photo.
458	A08-G21-1	Hairline crack starting at the left edge about in the middle and running horizontal approximately 7' (crack follows dark grey wet area).
459	A08-G22	No discrepancies and no photo.
460	A08-G23-1	Crack (1/16") with spalling running across the bottom-right corner from approximately 3' up the right edge to 3' left on the bottom edge (crack follows dark grey wet area).
461	A08-G24-1	Hairline crack starting at the bottom edge on the right-side of the panel and running vertical approximately 14' (crack follows dark grey wet area).
462	A08-G25	No discrepancies and no photo.
463	A08-G26-1	Crack (starts as 1/16" and ends as hairline) starting at bottom edge in the middle, going vertical and then splitting (crack follows dark grey wet area).
464	A08-G27	No discrepancies and no photo.
465	A08-G28	No discrepancies and no photo.
466	A08-G29-1	Crack (1/16") with spalling running from the bottom edge approximately 4' from the left corner and running vertical and toward the right side (crack follows dark grey wet area).
467	A08-G30-1	Hairline crack starting at the bottom edge in the middle of the panel and running vertical approximately 6' (crack follows dark grey wet area).
468	A08-H1	No discrepancies and no photo.
469	A08-H2-1	No discrepancies and no photo.
470	A08-H3	No discrepancies and no photo.
471	A08-H4-1	Spall (4"x5") at bottom-left corner.
472	A08-H5-1	Spall (4"x4") at bottom-left corner.
473	A08-H6-1	Spall (5"x5") at bottom-right corner.
474	A08-H7-1	Spall (2"x4") at bottom-right corner.
475	A08-H8	No discrepancies and no photo.
476	A08-H9	No discrepancies and no photo.
477	A08-H10-1	Spall (3"x4") at bottom-right corner.
478	A08-H11	No discrepancies and no photo.
479	A08-H12	No discrepancies and no photo.
480	A08-H13	No discrepancies and no photo.
481	A08-H14	No discrepancies and no photo.
482	A08-H15-1	Spall (3"x3") at top-left corner.
483	A08-H16	No discrepancies and no photo. Panel has a capped bore-hole.
484	A08-H17-1	Spall (3"x26") at bottom-left corner (horizontal and vertical).
485	A08-H18	No discrepancies and no photo.

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486	A08-H19	No discrepancies and no photo.
487	A08-H20	No discrepancies and no photo.
488	A08-I1	No discrepancies and no photo.
489	A08-I2	No discrepancies and no photo.
490	A08-I3	No discrepancies and no photo.
491	A08-I4	No discrepancies and no photo.
492	A08-I5	No discrepancies and no photo.
493	A08-I6	No discrepancies and no photo.
494	A08-I7	No discrepancies and no photo.
495	A08-I8	No discrepancies and no photo.
496	A08-I9-1	Hairline cracks (2 each) starting at the bottom edge and running vertical (cracks follows dark grey wet area).
497	A08-I10	No discrepancies and no photo.
498	A08-I11-1	Spall (3"x6") at bottom-right corner, with radial crack of approximately 8".
499	A08-I12	No discrepancies and no photo.
500	A08-I13	No discrepancies and no photo.
501	A08-I14	No discrepancies and no photo.
502	A08-I15	No discrepancies and no photo. Panel has a capped bore-hole.
503	A08-I16	No discrepancies and no photo.
504	A08-J1	No discrepancies and no photo.
505	A08-J2	No discrepancies and no photo.
506	A08-J3	No discrepancies and no photo.
507	A08-J4	No discrepancies and no photo.
508	A08-J5	No discrepancies and no photo.
509	A08-J6	Panel does not exist.
510	A08-J7	No discrepancies and no photo.
511	A08-J8	No discrepancies and no photo.
512	A08-J9	No discrepancies and no photo.
513	A08-J10	No discrepancies and no photo.
514	A08-J11	No discrepancies and no photo.
515	A08-J12	No discrepancies and no photo.
516	A08-J13	No discrepancies and no photo.
517	A08-J14	No discrepancies and no photo.
518	A08-J15	No discrepancies and no photo.
519	A08-J16	No discrepancies and no photo.
520	A08-K1-1	Spall (4"x4") at top-right corner.
521	A08-K2	No discrepancies and no photo.
522	A08-K3	No discrepancies and no photo.
523	A08-K4	No discrepancies and no photo.
524	A08-K5	No discrepancies and no photo.
525	A08-K6	No discrepancies and no photo.
526	A08-K7	No discrepancies and no photo.
527	A08-K8	No discrepancies and no photo.
528	A08-K9	No discrepancies and no photo.
529	A08-K10	Hairline crack starting at the bottom edge and going up approximately 4' (crack follows dark grey wet area).
530	A08-K11	No discrepancies and no photo.
531	A08-K12	No discrepancies and no photo.
532	A08-K13	No discrepancies and no photo.
533	A08-K14	No discrepancies and no photo.

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534	A08-CAP-1	Approximately 5 hairline cracks radiating from the center of panel. This example hairline crack with slight spalling radiates from center of panel towards panel K7.
535	A08-CAP-2	One non-radial hairline crack, looking from bottom of cap near panel K1 towards center of cap.
536	A08-VEG1	Dome with vegatation standing on the beach on the lagoon side
537	A08-VEG2	Dome with vegatation to the right as you walk onto the dome from the lagoon side.
538	A08-VEG3	Dome with vegatation to the left as you walk onto the dome from the lagoon side.
539	A08-VEG4	Dome with vegatation to the top as you walk onto the dome from the lagoon side.
540	A08-VEG5	Vines taking root in Joint B57-B58-C41-C42 as viewed from Panel B56.
541	A08-VEG6	Vines taking root in Joint B57-B58-C41-C42 as viewed from Panel B56.
542	A08-VEG7	Vines taking root in Joint B57-B58-C41-C42 as viewed from Panel B58.
543	A08-VEG8	Vines taking root in Joint B57-B58-C41-C42 as viewed from Panel B58.
544	A08-VEG9	Vines taking root in Joint B57-B58-C41-C42 as viewed from Panel B58.
545	A08-VEG10	Vines taking root in Joint B57-B58-C41-C42 as viewed from Panel C40.
546	A08-VEG11	Vines taking root in Joint B57-B58-C41-C42 as viewed from Panel C40.
547	A08-VEG12	Vines taking root in joint just below B57-B58-C41-C42 as viewed from Panel B58.
548	A08-VEG13	Vines taking root in joint just below B57-B58-C41-C42 as viewed from Panel B58.
549	A08-VEG14	Vines taking rooot in Joint B34-B35-C29-C30 as viewed from Panel C40.
550	A08-VEG15	Standing water outside ring-wall as viewed from Panel A13 towards Panel A14.
551	A08-VEG16	Vegetation as viewed from Panel B56 towards Panel B57.
552	A08-VEG17	Vegetation as viewed from Panel A41 towards Panel A40.
553	A08-VEG18	Vegetation as viewed from Panel A41 towards Panel A40.
554	A08-VEG19	Vegetation as viewed from Panel A41 towards Panel A40.
555	A08-VEG20	Vegetation as viewed from Panel B36 towards Panel B35.
556	A08-VEG21	Vegetation as viewed from Panel B36 towards Panel C30.
557	A08-VEG22	Vegetation as viewed from Panel C28 towards Panel B33 towards Panel A36.
558	A08-VEG23	Vegetation as viewed from Panel C30 towards Panel B36.
559	A08-VEG24	Vegetation as viewed from Panel C30 towards Panel B36.
560	A08-VEG25	Vegetation as viewed from Panel C30 towards Panel B36.
561	A08-VEG26	Clearing vegetation as viewed from A40 towards A41.
562	A08-VEG27	Cleared vegetation as viewed from B36 towards B35.
563	A08-VEG28	Cleared vegetation as viewed from B36 towards C30.
564	A08-VEG29	Cleared vegetation as viewed from B56 towards B57.
565	A08-VEG30	Cleared vegetation as viewed from B57 towards B58.
566	A08-VEG31	Clreaed vegetation that had to be left on dome due to time and access to remove from dome.

PHOTO DESCRIPTIONS
OF RUNIT DOME FIELD SURVEY

567	A08-VEG32	Clreaed vegetation that had to be left on dome due to time and access to remove from dome.
568	A08-VEG33	Clreaed vegetation that had to be left on dome due to time and access to remove from dome.
569	A08-VEG34	Clreaed vegetation that had to be left on dome due to time and access to remove from dome.
570	A08-SURVEY1	Survey Team - Team Leader - Doug Miller
571	A08-SURVEY2	Survey Team - Scribe - Judy Honda
572	A08-SURVEY3	Survey Team - Vegetation Crew Leader - Yota
573	A08-SURVEY4	Survey Team - Vegetation Crew
574	A08-SURVEY5	Survey Team - Vegetation Crew
	NOTES:	
	1 -	Photo ID Nomenclature; for example, A08-B44-1
		A - First survey of the fiscal year
		08 - Survey took place in fiscal year 2008
		B - Panel row per original 1982 drawing
		CAP - Dome Cap
		VEG - Vegetation
		SURVEY - Survey Crew
		44 - Panel 44 of Row B per original 1982 drawing
		1 - First photo taken of the panel indicated
	2 -	Actual survey took place from June 26-29, 2008
		June 26 (Thursday), 6:45AM-2:30PM (including travel and no meals)
		June 27 (Friday), 6:45AM-2:30PM (including travel and no meals)
		June 28 (Saturday), 6:45AM-4:00PM (including travel and lunch)
		June 29 (Sunday), 7:45AM-4:00PM (including travel and no meals)
	3 -	Survey Team:
		Douglas C. Miller, NSTec, Team Chief
		Judith H. Honda, NSTec, Team Coordinator (also Scribe)
		Yota Rilang, NSTec local hire, Team Crew Leader (Cleanup)
		Cleanup crew consisted of 2-6 NSTec local hires at any one time

Attachment 3

Digital photos from Runit Dome field survey (flash drive)

Photos available upon request

Attachment 4

Nevada Test Site General Report, Project No. 08109, Document No. 08109-RPT-0001.

Runit Dome Concrete Dome Evaluation, Revision 0

NEVADA TEST SITE
GENERAL REPORT

Project No. 08109

Document No. 08109-RPT-0001

RUNIT DOME CONCRETE DOME EVALUATION

Revision 0

Reviewed and determined to be UNCLASSIFIED
This review does not constitute clearance for public release

Derivative Classifier: Vinod Sehni / NSTec
(Name/Organization)

Date: 09/16/08

UNCLASSIFIED

Derivative Classifier: SEE Stamp Above Date: —

Preparer: See following page Date: 9/15/08

Checker: See following page Date: 9/15/08

Project Engineer: See following page Date: 9/15/08

Approver / Customer: [signature] Date: 9/16/08

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NNSA 9-15-08

NEVADA TEST SITE
GENERAL REPORT

Project No. 08109

Document No. 08109-RPT-0001

RUNIT DOME CONCRETE DOME EVALUATION

Revision 0

Derivative Classifier: _____ Date: _____

Preparer: Terence C Hall Date: 15 Sep 08

Checker: Robert Coppersmith Date: 9/15/08

Project Engineer: Thomas J. Tenney Date: 9/15/08

Approver / Customer: _____ Date: _____

NEVADA TEST SITE
GENERAL REPORT

Project No. 08109

Document No. 08109-RPT-0001

RUNIT DOME CONCRETE DOME EVALUATION

Revision 0

Derivative Classifier: _____ Date: _____

Preparer: _____ Date: _____

Checker: Roberto Caccavale Date: 9/15/08

Project Engineer: _____ Date: 9/15/08

Approver / Customer: _____ Date: _____

Title: Runit Dome Concrete Dome Evaluation Revision 0

Report Number: 08109-RPT-0001

Date: 9/15/08

Report Description:

The Runit Dome is a concrete cap poured over a filled crater with the crater created as part of the early testing in the Bikini and Enewetak Atolls. This dome was poured in the 1978 timeframe by the 84th Engineering Battalion and is approximately 18 inches thick, 400 feet in diameter, and 28 feet peak height at the center. Concerns over the condition of the dome resulted in the development of this report and will provide a remote assessment based on photographs and existing reports. The objects of this report are to determine the condition of the concrete in the dome, based upon available information, define appropriate steps to enhance evaluation of the concrete condition and recommend strategies for repair, as necessary.

Background:

Available Information

- Report A82, thought to be prepared by Holmes & Narver, June 1982, "Structural Monitoring of Cactus Crater Storage Facility (Runit Dome), 13 pp.
- Report prepared by Holmes & Narver, July 1988, excerpt from the 1988 "Cactus Crater Storage Facility Report," 4 pp.
- Excerpt from Runit Dome Survey, prepared by Holmes & Narver, FY 89, 2 pp.
- Excerpt from Runit Dome Survey, prepared by Raytheon Services Nevada, FY 90, 3 pp.
- 2008 photos and index from Doug Miller during 2008 evaluation visit.
- 2008 slide presentation prepared by Doug Miler regarding 2008 evaluation visit.

Information Not Available

- Service Life — Expected service life of the dome is a mandatory element required to make any decisions regarding repair and maintenance of the concrete in the dome.
- Moisture Penetration — There is a general level of concern for moisture penetrating the dome and is a critical issue for determining if repairs are necessary to provide water protection to the dome.
- Compaction — The degree of compaction of material placed in the crater under the dome is not known.
- Concrete — Actual concrete mixture used for the dome
- Construction and Curing — Practices used for construction and curing of the dome.
- Radiation Level — Is the level high enough to be of concern? This is a question internal resources should be able to answer.

General Information

- Constructed in 1978-1979 time frame
- Constructed by 84th Engineering Battalion. At that time, this unit was a construction battalion; appropriate equipment and better trained personnel.
- Dome concrete is 18-in.-thick, 400 ft in diameter, and approximately 28-ft-high
- Concrete ring wall or ring beam surrounds the dome. This serves to keep the base of the dome from spreading outward. It is not known if the wall is reinforced.
- During Doug Miller's visit to the dome in 2008, it was noted that there is a great amount of growth on the lower panels of the dome.

Title: Runit Dome Concrete Dome Evaluation Revision 0
Report Number: 08109-RPT-0001
Date: 9/15/08

Conclusions:

Condition of Concrete

In general, the photographs indicate that the concrete is in good condition and the dome was finished with a rough broom finish; most of the broom marks are visible.

There is no evidence in the photos that the concrete is showing any signs of disintegration, which is the loss of the ability of the paste to hold the concrete constituents together.

The concrete damage, based upon review of the photos listed below and made available from the 2008 site visit, includes:

- A08-C41-1 and A08-A2-1 — Numerous spalls along construction joints; most in the range of several inches in length.
- A08-D22-2 — Large corner cracking of several feet in length.
- A08-C43-1 — Corner spalls
- A08-C16-4 — Spalling along cracks, similar to spalling along construction joints.
- A08-C40-3 — Apparent construction flaw – poor consolidation.
- A08-A19-2 — Major surface failure. This is typically referred to as a delamination and is probably construction related.
- A08-B1-1 — Large spall.
- A08-B14-2 — Large pattern cracking.
- A08-A34-1 — Longer crack parallel to a construction joint.
- A08-D1-1 and A08-D2-2 — Numerous individual cracks.
- A08-A9-4 — Numerous intersecting individual cracks.
- A08-A20-2 — Significant amounts of dirt and debris in joints and cracks.
- A08-A14-2 — Significant vegetation growth in joints and cracks.

The damage that is seen falls into the general category of non-structural causes. There is no evidence that the structure has been loaded in any way since construction.

Most of the cracking is probably related to long-term drying shrinkage. Such shrinkage is inevitable with portland cement concrete.

The spalling is probably related to thermal expansion and contraction of the concrete. There is no indication that any provision was made during construction for movement of the panels over time. When the concrete cools, debris may be entering the joints and cracks, which would contribute to the potential for spalling as the concrete warms. This situation is similar to the highway blowups that are common in hot areas within the US.

Some of the spalling and cracking may be the result of settlement of the dome as the material inside has settled, corroded, or otherwise change volume since being placed. The 1982 report indicates that elevations were established for multiple locations on the dome. The actual measurements were not included in the excerpt of the report reviewed. There is no follow-up data on more recent elevations to indicate whether settlement is occurring. Some of the photos show raveling (spalling of the edges of a crack) along the edges of cracks indicating that the cracks had been in compression, most likely resulting from settlement.

The various reports mention that the "structural" condition of the dome is good. The use of the term structural must be taken in a very broad context here given that the dome is not a true structural member. What is actually being said is that the durability or serviceability of the dome is apparently good. It is assumed that the primary purpose of the concrete is to act as a physical barrier to prevent access to the material underneath.

The dome is located in a very benign climate for concrete. Little deterioration would be expected in this environment.

The most significant threat to the long-term durability of the concrete is the growth of vegetation. Roots are penetrating joints and cracks. As the roots become larger, the joints and cracks will open and spall. As they open, additional debris will enter and the cycle will feed upon itself.\

With no information available on the concrete mixture used, one can assume that local, chloride-contaminated aggregates may have been used. Even if chloride-contaminated materials were not used, it is safe to assume that the concrete is reasonably well saturated with chlorides at this time. In general, the presence of chlorides in concrete is not of a concern for unreinforced concrete. No data has been found regarding long-term detrimental chemical effects of chlorides in unreinforced concrete. For unreinforced concrete, calcium chloride and water reducing admixtures containing calcium chloride have long been used as accelerators. This practice continues today.

Neville (1996) discusses a process of physical chloride salt attack on concrete exposed to cycles of wetting with sea water or sea salts and subsequent drying. The result of this process is a physical deterioration of the paste resulting in the loss of aggregate particles. There is no evidence from the photos that any such process is taking place.

There may also be a concern over constituents other than chloride that are present in sea water, particularly sulfate compounds. Sulfates are recognized as attacking concrete, with the severity of the attack dependent upon the permeability of the concrete and the cat ion associated with the sulfate. This attack is also recognized by surface deterioration of the concrete. Again, no such surface deterioration is being seen.

It is unknown if the material under the dome is allowing wicking of sea water to the bottom side of the dome. This surface should be examined to determine whether any evidence of attack is visible on concrete that may be assumed to be continually wet.

Appropriate Action for Evaluation:

A defined list of purposes for the dome needs to be formally established to ensure all necessary assessment actions are prescribed. These actions should ensure that for each purpose there are assurances that the dome is sound. However, the following general actions should be considered as a minimum:

1. Visual inspection by an individual more familiar with concrete performance.
2. A limited coring program to provide representative cores for petrographic and chemical examination. Chemical examination would include determination of chloride profile within the concrete and any other testing suggested by the petrographic examination. Cores would be taken in undamaged concrete, across cracks, and across construction joints. All Cores would not necessarily need to be full depth. However, several full depth cores should be taken to allow examination of the bottom surface of the concrete for condition of the dome underside. Compressive strength testing of cores could help indicate the future life expected of the structure. However, taking and testing cores for compressive strength is a much more difficult proposition. Given the critical nature of the dome. A formal and well documented chain of custody method should be established prior to any coring. This will help to ensure that there are no questions concerning the validity of the data.
3. Hand excavation and examination of the outside face of the ring beam in several locations to determine if any deterioration is occurring in that concrete.
4. A photo-by-photo comparing the earliest photos available with the most recent photos to get an estimation of how damage is progressing.
5. Evaluation of the ring beam to determine the presence of reinforcing steel.
6. Elevations taken of the ring beam and dome and compared to any baseline measurements to determine if settlement has occurred. If a baseline was never established, the baseline measurements should be taken at this time and a schedule determined for future measurements.
7. Installation of simple crack movement indicators to allow for future determinations of crack and joint movement.

Possible Repair Strategies

To slow additional degradation, several actions are recommended. These include:

1. Implementation of an aggressive program of vegetation control to keep roots out of the construction joints and cracks.
2. Clean and fill existing spalls. There are many suitable bagged materials that could be specified for this task. An "add water only" type product would minimize site difficulties. This step would be appropriate only for the larger spalls.
3. Addressing the water movement through the cracks and joints, only if reduction of moisture ingress is determined to be important to serviceability of the dome. If determined to be necessary, this could be a major exercise given the size of the dome, and the number of joints and cracks.

Title: Runit Dome Concrete Dome Evaluation Revision 0
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References:

Neville, A. M., 1996, *Properties of Concrete*, Fourth Edition, John Wiley & Sons, Inc., New York, 844 pp.